Washington: "Washington Territory," 7 ♂; Spokane Falls, 1 ♂; Pullman, 4 ♂, 1 ♀.

Canada:

Quebec: Lanoraie, 1 ♀.

Manitoba: Onah, 8 ♂; Aweme, 1 ♂.

British Columbia: 1 ♂, 1 ♀; Nelson, 1 ♂; Golden, 1 ♂; Nanaimo, Vancouver's Island, 1 ♂, 1 ♀; Peachland, 3 ♂, 7 ♀; Buccaneer Bay, 2 ♂, 1 ♀.

North West Territory: 1 ♂.

Curvata becomes larger and darker, and even develops a slight iridescence in the specimens from more mountainous portions of its range. These larger, darker specimens closely resemble *serotina* Le Conte in appearance, and are usually so named in collections. The smaller, pallid specimens coming from the foothills and plains regions are not common in collections and have usually remained unnamed. With only a few specimens at hand the student would not, without the aid of the genital characters, correctly connect up the extremes of variation in size and color which occur in this species. The northwest Nebraska specimens (which presumably come from near the source of the type specimens) are quite typical. A dissected male bearing the data "Monroe Canyon, Sioux County, Nebraska, June 23, 1911 (R. W. Dawson)" was carefully matched up with the dissected holotype and used in preparing the drawings on the accompanying plate, and in taking the detailed measurements above given.

THE INSECTS AND PLANTS OF A MOIST WOODS ON THE PIEDMONT PLAIN OF NEW JERSEY.

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The present paper deals with the results of a survey of the insects and plants found in a moist woods and adjoining thicket at Monmouth Junction, N. J. Collecting extended over the greater parts of 1920 and 1921 and during 1921 it took place at regular weekly intervals during the spring, summer and autumn. It is realized that collecting over two years is not exhaustive in so far as the insects are concerned.

Each season brings its own species to the front and species which are taken in numbers one year may be missing the next; in fact collecting varies from week to week and day to day. However it is thought that the records included in this paper represent about fifty per cent. of the species likely to be found in such a situation.

New Jersey is a portion of the Atlantic Slope of the United States and the boundary between the geographic and geologic provinces known as the Coastal Plain and Appalachian province extends obliquely across the state in nearly a straight line through Trenton and New Brunswick. Three of the four major divisions of the Appalachian province enter New Jersey, these being the Appalachian Valley, Appalachian Mountains and the Piedmont Plateau. In New Jersey the Appalachian Mountains form a belt known as the

FIG. 1. Relief map of New Jersey showing geographic provinces (Dept. Cons. and Develop. N. J.).

Highlands and the Piedmont Plateau is called the Piedmont Plain. Figure 1 shows the geographic provinces of the state.

Monmouth Junction, where the survey was made, is located on the lower edge or border of the Piedmont Plain about ten miles below New Brunswick. This Plain is "chiefly a lowland of gently rounded hills separated by wide valleys with some ridges and isolated hills rising conspicuously above the general surface, which slopes gently from about 400 feet above sea level at its northwestern margin to about 100 feet along its southeastern border near the Delaware and to sea level about Newark Bay." [1]

The rocks of the different parts of the Piedmont Plain differ widely in age. The section surveyed lies very close to if not on the line separating the trap rock and shale formations. The shale is baked for some distance from the trap intrusion and its color and physical characteristics changed until it somewhat resembles trap rock. The soil towards the surface may be either washed from the trap rock hills at the back or may be partly broken down, baked shale.

Hollick [2] outlines three forest zones for New Jersey, the deciduous zone, the tension zone and the coniferous zone. The tension zone is bounded by an irregular line drawn from a little east of Metuchen to Trenton and a similar one from Long Branch to Salem. North of the first line will be found the typical deciduous region and south of the second line, the typical coniferous zone. Between the two lines is an area about sixteen miles wide "which may be termed the tension zone because it is there that the two floras meet and overlap, producing a constant state of strain or tension in the struggle for advantage." Within the limits of either the deciduous or coniferous zone, the typical characteristic species of each have become firmly established and conditions are more or less uniform. The forests of the Piedmont Plain are deciduous and according to Smith (Insects of New Jersey, p. 28) insect life is less abundant than to the north or south. Part of it is largely under cultivation and has many large swamp areas and low meadow regions.

The surveyed area consisted of about twenty-two acres of gently sloping, moist woods and thicket just above or on the southern border of the deciduous zone. The woods occupied about fifteen acres and

[1] Lewis and Kummel, Bul. 14, Geol. Survey N. J., p. 28.

[2] Ann. Rept. State Geol. N. J., 1899, pp. 177–201.

the adjoining thicket about seven acres. The exact location will be found on the map marked figure 2. This area is drained by tributaries of the Raritan River and lies in about latitude 40° 23′ N. and

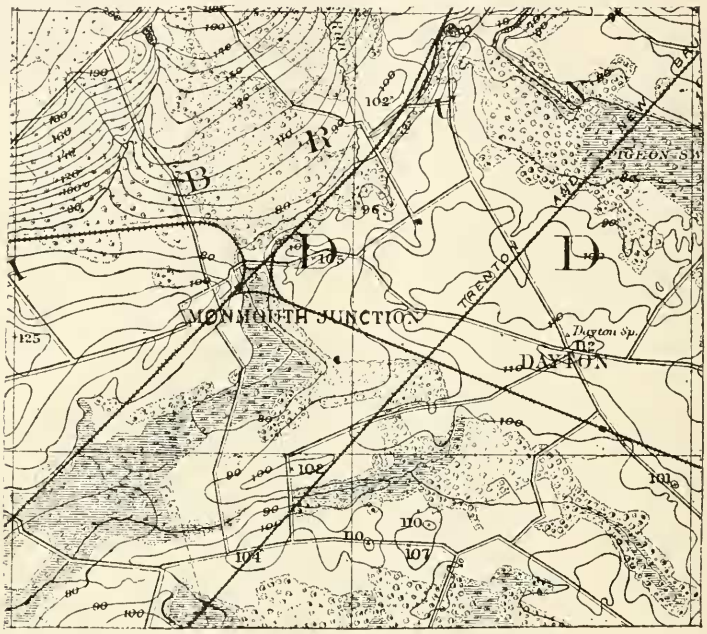

FIG. 2. Map of Monmouth Junction, N. J.; the letter B above the railroad branch curving up and to the left marks the exact spot where the survey was made.

longitude 74° 33′ W., at an altitude of 110 feet. The top soil of the woods and thicket, particularly of the woods, was very rich in humus and many low, wet spots occurred throughout the greater portion of the woods. As a rule the thicket was considerably drier. No streams were present in either the woods or thicket but the surrounding territory contained many swampy areas and several brooks. In view of this together with the dense shade, conditions in the woods were usually moist throughout the growing seasons. The flora of the area was typical of many of the numerous similar woods found in the Piedmont Plain. The ground was moist with many wet spots but seldom became swampy. The vegetation was consequently mesophytic

throughout. The plants were listed on weekly trips to the area during the year 1921, from March to October. The vegetation fell naturally into two more or less distinct series, the woods and thicket, depending on the presence or absence of large trees. The general aspect of the two series was quite similar in respect to actual species present but each had groups or successions that were characteristic.

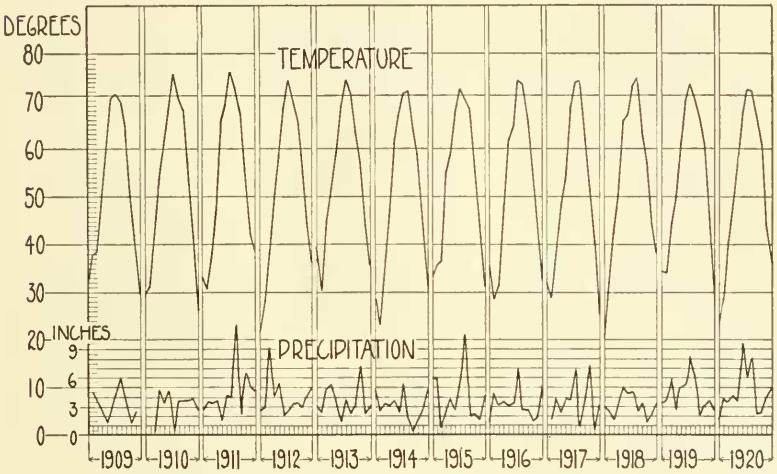

Fig. 3. Chart showing mean temperature and precipitation by months from 1909 to 1920 at New Brunswick, N. J., about ten miles from Monmouth Junction.

The Woods.

The flora of the woods may be divided into the following four groups: trees, shrubs, herbs and fungi. While numerous species were found in each group, the majority of individuals belonged to a few species which stood out from the remainder of the vegetation. Among the trees, the red maple (*Acer rubrum*) was the dominant species. This together with the oaks (*Quercus palustris*, *Q. rubra* and *Q. alba*) contributed over half the trees in the woods. Clumps of ironwood (*Carpinus caroliniana*) together with sweet gum (*Liquidambar styraciflua*) and the beech (*Fagus grandiflora*) added another quarter. Clumps of gray birch (*Betula populifolia*) in various stages of decay indicated that this species was an important element before the taller oaks and maples attained their maximum height and cut off

the sunlight required by the low growing birch. This was further demonstrated in the thicket where the birch was an important and vigorous element and the oaks and maples still small. The remainder of the trees consisted of scattered specimens of oaks, sour gums, hickories, etc., including a few sickly chestnuts (*Castanea dentata*). This species was formerly a conspicuous member in the tree flora but it has been almost entirely eliminated by the bark disease *Endothia parasitica.*

The shrubs included the viburnums with *Viburnum dentatum* as the most frequent; the spice bush (*Benzoin æstivale*); large clumps of elder (*Sambucus canadensis*) and in the more open places dense thickets of green briar (*Smilax rotundifolia*). Several species of *Rubus* with a scattering of other genera made up the remainder of the shrubs.

The herbaceous flora was distributed over a series beginning with a very rich and conspicuous vernal flora followed by a straggling succession that was marked by few important species. Before the trees expanded their leaves enough to form much shade, the floor of the woods was covered with a carpet of showy spring plants. These included the wood anemone (*Anemone quinquefolia*), spring beauty (*Claytonia virginica*), Indian Turnip (*Arisæma trifolium*), several violets among which *Viola papilionacea* was prominent, early crowfoot (*Ranunculus fascicularis*) in the wet places and vast areas covered with May apple (*Podophyllum peltatum*) and the fawn lily (*Erythronium americanum*). In the more open spots the wild cranesbill (*Geranium maculatum*) was found. The other half of the flora included a great number of species of which over half belonged to the Liliales and the Ranunculales.

This vernal flora gradually ripened and disappeared as the leaf canopy of the trees reached its early summer density. Large patches of poison ivy (*Rhus toxicodendron*) and Virginia creeper (*Psedera quinquefolia*), sometimes intermingled, covered much of the forest floor. In the dense shade neither species showed any tendency to climb. The moist spots were covered with the spotted touch-me-not (*Impatiens biflora*). In mid-summer, water hemlock (*Cicuta maculata*) was conspicuous on account of its white umbels. In late summer rattlesnake root (*Prenanthes alba*) became the most conspicuous species. The other plants making up the post-vernal flora were not

confined to any particular group. Only one fern, the sensitive fern (*Onoclea sensibilis*), which occurs in patches in wet places, was ever a conspicuous element.

Among the fungi most of the conspicuous forms belonged to the Polyporaceæ and Agaricaceæ in the order Agaricales. Much of the dead wood was occupied by such forms as *Polyporus versicolor, P. pargamenus, Dædalia quercina* and similar coriaceous species throughout the year. Of the soft fleshy plants in the Agaricaceæ, those belonging to the genera *Pleurotus, Pluteus, Russula, Lactarius, Collybia* and *Clitocybe* were the most conspicuous during the summer months.

The Thicket.

The flora of the thicket was less sharply divided into groups than that of the woods but there were again present the trees, shrubs and herbs. In this area the fungus flora was negligible. As will be noted many of the characteristic plants of the tree and shrub groups in the woods held correspondingly important places here. The herbaceous flora presented an entirely new series with the exception of a few vernal plants.

The most important tree element in the thicket was the gray birch (*Betula populifolia*) which contributed about one third of the woody plants. The red maple (*Acer rubrum*) and the oaks (*Quercus rubra, Q. palustris, Q. alba*) followed next in importance and were the forerunners of the woods to follow. Patches of young sweet gums and a generous sprinkling of elm (*Ulmus americana*) completed the major tree elements.

The shrubs in the thicket did not contrast greatly with the trees due to the large number of individuals of the latter group present. However dwarf sumach (*Rhus copallina*), a typical shrub, was second numerically only to the gray birch among the woody plants. Almost impenetrable patches of blackberry (*Rubus alleghensis*) occupied the open spaces and green brier (*Smilax rotundifolia*) the more shaded places. There were also several large areas covered with hazelnut (*Corylus americana*). Three patches in almost pure stand of *Cornus paniculatus* were conspicuous in late spring for their white flowers and during the winter for their groups of slender wiry stems. These five species included at least half the individuals among the shrubs.

The herbaceous flora in the thicket was the most complicated of the three groups. It exceeded the other groups in number both of individuals and of species. It far exceeded the corresponding group in the woods. It began with a conspicuous vernal flora followed by a less well-defined early and late summer series and ended with a distinct and showy autumn group. The spring flowers included many of those found in the woods at this time such as *Claytonia virginica, Erythronium americanum, Geranium maculatum,* and *Anemone quinquefolia* with the addition a little later of tinker's weed (*Triosteum perfoliatum*) and cinquefoil (*Potentilla canadensis*). The little Potentilla remained after the other spring flowers had gone and its creeping stems with a few grasses and an occasional dewberry (*Rubus villosus*) covered the floor of the thicket throughout the growing season. Among the early summer flowers that followed the spring group were the primroses *Oenothera pumilla* and *O. pratensis,* loosestrife (*Lysimachia quadrifolia*), a very important but inconspicu-

INSECTS OF THE WOODS (No. SPECIES).

Order.	Sifting.	In dead stumps under bark, etc.	Under stones.	In dead trees.	Flying or sweeping.	On flowers.	Galls.	Miners.	Fungous forms.	Aphids, scales.	Totals.
Collembola	1								2		3
Ephemerida					1						1
Megaloptera					1						1
Odonata					4						4
Orthoptera					3						3
Isoptera		1									1
Coleoptera	30	32	14	6	31	5	1		45		164
Thysanoptera									1		1
Corrodentia	1										1
Hemiptera	3	3			8						14
Homoptera					9					8	17
Neuroptera					1						1
Trichoptera					1						1
Lepidoptera		1			38			4			43
Mecoptera					1						1
Diptera					41	3	9		3		56
Hymenoptera	3	8	3		31	6	6				57
Acarina	1						2		2		5
Totals	39	45	17	6	170	14	18	4	53	8	374

ous element, the tick trefoils (*Desmodium canadense* and *D. paniculatum*), with a scattering of common milkweed (*Asclepias syriaca*) and yarrow (*Achillea millefolium*). Between this group and the autumn flowers was a period in which various plants with conspicuous flowers matured but they were so well distributed over a large number of species that not one stood out as more important than another. Of the whole number of these species half perhaps belonged to the order Polemoniales with the mints (Labiatæ) ranking as the most important family. These merged into the most showy

Insects of the Thicket (No. Species).

Order.	Flying, sweeping.	In pool.	On flowers.	Galls.	Aphids.	In ants' nest.	Large ants' nests.	Totals.
Odonata	7							7
Orthoptera	6							6
Coleoptera	44	3	10			2		59
Hemiptera	23	1						24
Homoptera	20			1	5			26
Trichoptera	1							1
Lepidoptera	25							25
Mecoptera	1							1
Diptera	47			7				54
Hymenoptera	17		5	5			2	29
Acarina				1				1
Totals	191	4	15	14	5	2	2	233

Additional Insects Common to Both Woods and Thicket (No. Species).

Order.	Flying or sweeping.	Galls.	On flowers.	Totals.
Odonata	1			1
Orthoptera	1			1
Coleoptera	10			10
Hemiptera	4			4
Homoptera	10			10
Neuroptera	2			2
Lepidoptera	8			8
Diptera	10	2		12
Hymenoptera	1	1	2	4
Totals	47	3	2	52

group of the season, the autumn plants including the asters and goldenrods. *Aster vimineus* was the most important though it was far less conspicuous than the less common purple *Aster novæ-angliæ*. *Solidago rugosa* and *S. canadensis* were the most important of the goldenrods and they occupied about half of the area of the open places. Other plants noticeable at this time included the purple gerardia (*Gerardia purpurea*), joe pye weed (*Eupatorum purpureum*) and common thistle (*Cirsium lanceolatum*). The various grasses were not listed or identified because they were unimportant. A more complete list of the plants of the woods and thicket will be found at the end of the paper.

During the survey no attempt was made to connect up every species of insect with a definite plant host, consequently the results as outlined show, in a general way, only the species found in certain situations and indicate the relative importance of various groups in such situations. The following tables summarize the findings in the woods and thicket.

RESULTS OF SIFTING IN THE WOODS.

Orders.	Families.	No. species.	Family habits.
Collembola	.....	1	Saprophagous
Coleoptera	Carabidæ	3	Predacious
	Silphidæ	1	Saprophagous
	Scydmænidæ	1	Predacious
	Staphylinidæ	15	Predacious and saprophagous
	Pselaphidæ	1	Saprophagous
	Ptiliidæ	1	"
	Scaphidiidæ	2	"
	Anthicidæ	1	?
	Erotylidæ	1	Saprophagous
	Cryptophagidæ	1	"
	Colydiidæ	1	"
	Scarabæidæ	2	Saprophagous varied
Corrodentia	Psocidæ	1	Saprophagous
Hemiptera	Lygæidæ	3	Phytophagous
Hymenoptera	Ceraphronidæ	1	
	Formicidæ	2	Varied
Acarina	Oribatidæ	1	Saprophagous and phytophagous
Total		39	

The following tables deal with the families represented in the various situations in the woods and thicket.

Most of the sifting was done around the bases of the larger trees and in the drier portions of the woods. Almost 80 per cent. of the species found in such situations belonged to the Coleoptera with the Staphylinidæ supplying the largest number in this order.

In Dead Stumps, under Bark, etc., in Woods.

Orders.	Families.	No. species.	Family habits.
Isoptera	Termitidæ	1	Saprophagous
Coleoptera	Carabidæ	7	Predacious
	Staphylinidæ	2	Predacious and saprophagous
	Histeridæ	1	Predacious
	Lampyridæ	1	"
	Elateridæ	3	Saprophagous, varied
	Ostomidæ	1	Predacious and saprophagous
	Nitidulidæ	2	Predacious, varied
	Cucujidæ	3	" "
	Erotylidæ	1	Saprophagous
	Colydiidæ	1	"
	Mycetæidæ	2	"
	Tenebrionidæ	5	"
	Melandryidæ	1	"
	Lucanidæ	1	"
	Scolytidæ	1	Phytophagous
Hemiptera	Aradidæ	2	Saprophagous
	Anthocoridæ	1	?
Lepidoptera	Noctuidæ	1	Saprophagous
Hymenoptera	Formicidæ	6	Saprophagous, varied
	Halictidæ	2	Pollenizers
Total		45	

Dead trees, stumps, fallen limbs, etc., were plentiful in the woods and such habitations yielded 45 species, with the Coleoptera supplying about 73 per cent. of them. The remainder was made up mostly by

Under Stones in Woods.

Orders.	Families.	No. species.	Family habits.
Coleoptera	Carabidæ	13	Predacious
	Tenebrionidæ	1	Saprophagous
Hymenoptera	Formicidæ	3	Saprophagous, varied
Total		17	

termites and ants. The one species in the Lepidoptera consisted of the noctuid *Scolecocampa liburna* Geyer whose larva lives in decayed wood. In the Hymenoptera, *Halictus pura* (Say) and a species of *Chloralictus* were taken from a dead birch stump where they were nesting.

In one of the drier upper portions of the woods were comparatively small stones and the 17 species, mostly of Coleoptera, were collected under them.

IN DEAD TREES IN THE WOODS.

Orders.	Families.	No. species.	Family habits.
Coleoptera.....	Melasidæ.....	1	Saprophagous
	Mycetophagidæ ...	1	"
	Anobiidæ.....	1	"
	Curculionidæ.....	2	Phytophagous
	Scolytidæ.....	1	"
Total.....		6	

Dead trees, particularly standing or recently fallen ones which had not started to decay, yielded *Isorhipis ruficornis* (Say) and *Ptilinus ruficornis* Say both of which were fairly numerous in dead red maple where they develop. The dead hickories were infested by *Cryptorhynchus obtentus* (Hbst.), the ash by *Leperisinus aculeatus* (Say), and from dead oaks *Stenoscelis brevis* (Boh.) was taken.

The 170 species listed above were taken by being captured in flight or by sweeping the vegetation on the ground, the shrubs and low tree branches. The Diptera supplied the largest number of species, namely 24 per cent. of the toal number, and was followed by the Lepidoptera with 22 per cent., the Coleoptera with 18 per cent. and the Hymenoptera also with 18 per cent. The numerous families represented in these orders are shown above. Several species of Microlepidoptera as yet unidentified were collected and many others observed.

Taken Flying or Sweeping in the Woods.

Orders.	Families.	No. species.	Family habits.
Ephemerida		1	Predacious
Megaloptera	Sialididæ	1	
Odonata	Agrionidæ	4	Predacious
Orthoptera	Tettigoniidæ	2	Phytophagous
	Gryllidæ	1	"
Coleoptera	Cicindelidæ	1	Predacious
	Carabidæ	3	"
	Staphylinidæ	2	Saprophagous and predacious
	Histeridæ	1	Predacious
	Cantharidæ	3	Predacious
	Elateridæ	2	Saprophagous
	Melandryidæ	1	"
	Scarabæidæ	2	"
	Cerambycidæ	6	Phytophagous
	Chrysomelidæ	7	"
	Curculionidæ	3	"
Hemiptera	Pentatomidæ	1	Predacious and phytophagous
	Coreidæ	1	Phytophagous
	Lygæidæ	1	"
	Nabidæ	1	Predacious
	Miridæ	4	Phytophagous
Homoptera	Membracidæ	2	"
	Cicadellidæ	6	"
	Fulgoridæ	1	"
Neuroptera	Mantispidæ	1	Parasitic
Trichoptera		1	Phytophagous
Lepidoptera	Papilionidæ	1	"
	Pieridæ	1	"
	Nymphalidæ	1	"
	Lycænidæ	1	"
	Hesperidæ	2	"
	Arctiidæ	1	"
	Noctuidæ	11	"
	Drepanidæ	2	"
	Geometridæ	11	"
	Limacodidæ	2	"
	Pyralidæ	3	"
	Tortricidæ	1	"
	Adelidæ	1	"
Mecoptera	Panorpidæ	1	?
Diptera	Chironomidæ	2	Saprophagous, etc.
	Culicidæ	3	" "
	Mycetophilidæ	2	Saprophagous
	Stratiomyidæ	1	"
	Tabanidæ	1	Predacious, etc.
	Leptidæ	2	" "
	Asilidæ	2	" "
	Dolichopodidæ	1	" "
	Empididæ	4	" "
	Pipunculidæ	1	?
	Syrphidæ	7	Saprophagous
	Tachinidæ	2	Parasitic

Orders.	Families.	No. species.	Family habits.
Diptera, *Cont.* ..	Muscidæ.....	1	Saprophagous
	Anthomyidæ.....	2	Phytophagous, etc.
	Scatophagidæ.....	3	Saprophagous
	Sciomyzidæ.....	2	?
	Sapromyzidæ.....	4	Saprophagous
	Trypetidæ.....	1	Phytophagous
Hymenoptera...	Tenthredinidæ.....	2	"
	Oryssidæ.....	1	"
	Braconidæ.....	1	Parasitic
	Banchidæ.....	1	"
	Ichneumonidæ.....	14	"
	Cynipidæ.....	1	Phytophagous
	Pteromalidæ.....	1	Parasitic
	Psammocharidæ...	2	Predacious
	Eumenidæ.....	1	"
	Vespidæ.....	2	"
	Sphecidæ.....	2	"
	Apoidea.....	1	Pollenizer
	Andrenidæ.....	1	"
	Apidæ.....	1	"
Total.....		170	

ON FLOWERS IN WOODS.

Orders.	Families.	No. species.	Family habits.
Coleoptera.....	Mordellidæ.....	1	Saprophagous
	Buprestidæ.....	1	Phytophagous
	Scarabæidæ.....	1	Saprophagous, varied
	Cerambycidæ.....	1	Phytophagous
	Curculionidæ.....	1	"
Diptera.....	Chironomidæ.....	1	Saprophagous, etc.
	Syrphidæ.....	1	" "
	Anthomyidæ.....	1	Phytophagous
Hymenoptera...	Formicidæ.....	1	Varied
	Sphecidæ.....	1	Predacious
	Andrenidæ.....	1	Pollenizer
	Ceratinidæ.....	1	"
	Apidæ.....	2	"
Total.....		14	

With the exception of the spring flowers which were very ephemeral and a few late asters, there were almost no flowers in the woods and this accounts for the small number of flower visitors.

Galls in the Woods.

Orders.	Families.	No. species.	Family habits.
Coleoptera.....	Buprestidæ.....	1	Phytophagous
Diptera.....	Itonididæ.....	9	"
Hymenoptera...	Cynipidæ.....	6	"
Acarina.....	Eriophyidæ.....	2	"
Total		18	

Eighteen species of galls were fairly common and further searching would have undoubtedly added additional species especially in the Hymenoptera.

Leaf Miners in the Woods.

Order.	Family.	No. species.	Family habits.
Lepidoptera....	Tineidæ.....	4	Phytophagous
Total.....		4	

Fungous Insects in the Woods.

Orders.	Families.	No. species.	Family habits.
Collembola	.....	2	Saprophagous
Coleoptera.....	Silphidæ.....	1	"
	Staphylinidæ.....	10	Predacious, saprophagous
	Histeridæ.....	1	Predacious
	Scaphidiidæ.....	1	Saprophagous
	Dascyllidæ	1	" ?
	Ostomidæ.....	1	Predacious, varied
	Nitidulidæ.....	7	" "
	Erotylidæ.....	3	Saprophagous
	Cryptophagidæ....	1	"
	Colydiidæ.....	1	"
	Endomychidæ.....	1	"
	Tenebrionidæ.....	3	"
	Melandryidæ.....	2	"
	Anobiidæ.....	2	"
	Cisidæ.....	9	"
	Anthribidæ.....	1	"
Thysanoptera...	.....	1	"
Diptera.....	Tipulidæ.....	1	"
	Mycetophilidæ....	1	"
	Ortalidæ.....	1	"
Acarina.....	Oribatidæ.....	2	"
Total.....		53	

The rich fungus flora consisted mainly of polypores thriving on the many trees and stumps in various stages of decay and numerous species of gill fungi supported by the moist forest soil. Of the 53 species of insects collected, the Coleoptera supplied the major portion. Undoubtedly, the Mycetophilidæ in the Diptera would have been better represented had it been possible to breed out the fungus gnats infesting the gill fungi.

SCALES AND APHIDS IN THE WOODS.

Order.	Families.	No. species.	Family habits.
Homoptera.....	Coccidæ.....	2	Phytophagous
	Aphididæ.....	6	"
Total.....		8	

From a pool in the woods which later dried up, a specimen of *Hydrophilus obtusatus* Say (Col.) was taken on April 6.

IN THE THICKET POOL.

Orders.	Families.	No. species.	Family habits.
Coleoptera.....	Dytiscidæ.....	3	Predacious
Hemiptera.....	Gerridæ.....	1	"
Total.....		4	

Collecting in the thicket was slightly better than in the woods insofar as sweeping was concerned. Here the Coleoptera supplied 23 per cent. of the species, the Lepidoptera 13 per cent., the Hymenoptera 9 per cent., the Diptera 24 per cent., the Homoptera 10 per cent. and the Hemiptera 12 per cent. The two last named orders were comparatively unimportant in the woods but came into more prominence in the thicket.

TAKEN FLYING OR SWEEPING IN THE THICKET.

Orders.	Families.	No. species.	Family habits.
Odonata	Agrionidæ	2	Predacious
	Libellulidæ	5	"
Orthoptera	Tetrigidæ	1	Phytophagous
	Tettigoniidæ	2	"
	Gryllidæ	3	"
Coleoptera	Carabidæ	1	Predacious
	Cantharidæ	3	"
	Elateridæ	2	Saprophagous, phytophagous
	Buprestidæ	9	Phytophagous
	Colydiidæ	1	Saprophagous
	Phalacridæ	1	"
	Coccinellidæ	2	Predacious
	Scarabæidæ	1	Saprophagous, phytophagous
	Cerambycidæ	3	Phytophagous
	Chrysomelidæ	13	"
	Mylabridæ	1	"
	Curculionidæ	7	"
Hemiptera	Cydnidæ	1	?
	Pentatomidæ	4	Phytophagous, predacious
	Neididæ	1	Phytophagous
	Lygæidæ	2	"
	Tingididæ	1	Phytophagous
	Phymatidæ	1	Predacious
	Reduviidæ	1	"
	Miridæ	12	Phytophagous
Homoptera	Cercopidæ	1	"
	Membracidæ	6	"
	Cicadellidæ	11	"
	Fulgoridæ	1	"
	Chermidæ	1	"
Trichoptera	Phryganeidæ	1	?
Lepidoptera	Satyridæ	2	Phytophagous
	Nymphalidæ	3	"
	Hesperidæ	5	"
	Saturniidæ	1	"
	Arctiidæ	1	"
	Noctuidæ	3	"
	Notodontidæ	1	"
	Geometridæ	2	"
	Pyralidæ	5	"
	Haploptiliidæ	1	"
	Nepticulidæ	1	"
Mecoptera	Panorpidæ	1	?
Diptera	Tipulidæ	1	Saprophagous
	Culicidæ	2	"
	Tabanidæ	4	Predacious
	Leptidæ	1	"
	Bombyliidæ	2	Parasitic
	Asilidæ	4	Predacious
	Dolichopodidæ	5	Adults predacious
	Empididæ	3	Predacious
	Syrphidæ	5	Saprophagous

Orders.	Families.	No. species.	Family habits.
Diptera *Cont.*....	Tachinidæ.....	8	Parasitic
	Sarcophagidæ.....	1	Parasitic, saprophagous
	Anthomyidæ.....	2	Phytophagous, etc.
	Sapromyzidæ.....	2	Saprophagous
	Trypetidæ.....	3	Phytophagous
	Sepsidæ.....	1	Saprophagous
	Oscinidæ.....	2	Phytophagous
	Agromyzidæ.....	1	"
Hymenoptera...	Tenthredinidæ.....	3	"
	Vipionidæ.....	1	Parasitic
	Braconidæ.....	1	"
	Ichneumonidæ.....	3	"
	Serphidæ.....	1	"
	Formicidæ.....	1	Varied
	Eumenidæ.....	2	Predacious
	Vespidæ.....	2	Predacious, etc.
	Sphecidæ.....	2	" "
	Megachilidæ.....	1	Pollenizers
Total.....		191	

ON FLOWERS IN THE THICKET.

Orders.	Families	No. species.	Family habits.
Coleoptera.....	Melyridæ.....	1	Predacious
	Œdemeridæ.....	1	?
	Mordellidæ.....	2	Saprophagous, varied
	Elateridæ.....	1	" phytophagous
	Melandryidæ.....	1	Saprophagous
	Scarabæidæ.....	1	Saprophagous, varied
	Cerambycidæ.....	3	Phytophagous
Hymenoptera...	Tenthredinidæ.....	1	"
	Chalcididæ.....	1	Parasitic
	Andrenidæ.....	2	Pollenizers
	Xylocopidæ.....	1	"
Total.....		15	

GALLS IN THE THICKET.

Orders.	Families.	No. species.	Family habits.
Homoptera.....	Aphididæ.....	1	Phytophagous
Diptera.....	Itonididæ	6	"
Hymenoptera...	Cynipidæ.....	5	"
Acarina.....	Eriophyidæ.....	1	"
Diptera.....	Trypetidæ.....	1	"
Total.....		14	

Six species of Aphididæ were found in the thicket on such plants as goldenrod, birch, witch hazel, elm and willow. *Hamamelistes spinosus* Shimer was very abundant on young birch and did considerable damage.

In the open and semi-open spaces of the thicket, *Formica exsectoides* Forel had constructed large mounds and the inhabitants swarmed over much of the nearby vegetation. Some of the mounds were 21 inches high and 4 feet in diameter at the base. In the dense portions of the thicket, what appeared to be abandoned mounds of *exsectoides* were noted. These were more or less grass covered and contained small colonies of *Lasius umbratus minutus* in

Additional Species Found in Both Woods and Thicket.

Orders.	Families.	No. species.	Family habits.
Odonata	Agrionidæ	1	Predacious
Orthoptera	Tettigoniidæ	1	Phytophagous
Coleoptera	Lycidæ	1	Saprophagous
	Lampyridæ	1	Predacious
	Buprestidæ	2	Phytophagous
	Chrysomelidæ	5	"
	Curculionidæ	1	"
Hemiptera	Pentatomidæ	2	Phytophagous, predacious
	Lygæidæ	1	Phytophagous
	Reduviidæ	1	Predacious
Homoptera	Cicadidæ	1	Phytophagous
	Cercopidæ	1	"
	Membracidæ	1	"
	Cicadellidæ	5	"
	Fulgoridæ	2	"
	Chermidæ	(Several not det.)	"
Neuroptera	Chrysopidæ	2	Predacious
Lepidoptera	Nymphalidæ	1	Phytophagous
	Lycænidæ	2	"
	Hesperiidæ	1	"
	Saturniidæ	1	"
	Pyralidæ	1	"
	Eucosmidæ	1	"
	Heliozelidæ	1	"
Diptera	Tipulidæ	2	Saprophagous
	Culicidæ	2	Saprophagous
	Dolichopodidæ	2	Adults predacious
	Syrphidæ	1	Saprophagous
	Scatophagidæ	1	"
	Sciomyzidæ	2	?
Hymenoptera	Tenthredinidæ	1	Phytophagous
Total		47	

the galleries of which were collected aphids which Prof. Gillette thought might represent a new species of *Thecabius*. Two species of Staphylinidæ, namely *Atheta nigritula* Grav. and *Tachyporus nitidulus* Fab., were found in the nests of *exsectoides*.

In addition to the above, *Gryllus assimilis luctuosus* Serv. was found on the ground of both woods and thicket. The grape filbert gall *Schizomyia coryloides* Walsh & Riley and the ironwood leaf fold gall *Cecidomyia pudibunda* O.S. were also noted in both areas. In the Hymenoptera, *Andrena carlini* Ckll. was taken while flying in the woods on April 14 and also while visiting *Salix discolor* catkins in the thicket on March 28. *Halictus pura* Say visited dogwood flowers in the thicket on April 25 and cranesbill flowers in the woods on May 7. The blackberry seed gall *Diastrophus cuscutæformis* O.S. was common in the thicket and to a less extent in the woods.

SUMMARY.

The amount and character of insect injury to the trees and plants in the woods and thicket varied considerably but in most instances it appeared to be a negligible incident in the life of the plant. During the season of 1921, only the birches in the thicket were seriously injured. During the early summer they were attacked by plant lice and later by the birch leaf skeletonizer *Bucculatrix canadensiella* Cham. (Lep.). By the end of summer they appeared fire-swept. In the woods, the few remaining birches were rapidly disappearing under the combined attacks of *Polyporus betulinus* and the bronze birch borer *Agrilus anxius* Gory.

The foregoing tables show that a mixed forest with shrubby and herbaceous growths of various kinds supports a varied insect fauna. Some of the insects feed on the foliage, others live in the rotting wood of fallen limbs and trees, others upon the polypores and gill fungi found in such situations and others are parasitic or predaceous upon both injurious and beneficial forms. In this way a natural balance is preserved. The following table shows the comparative abundance of various types of food habits of the species taken. While some of the species may be wrongly classified due to ignorance of their correct food habits, yet the tables show in a general way the predominating types in the situations surveyed.

TYPES OF FOOD HABITS.

Situation.	Phytophagous, No. species.	Saprophagous, No. species.	Predacious, No. species.	Parasitic, No. species.	Pollenizers, No. species.	Totals
WOODS						
Sifting	3	30	4			37
In dead stumps, etc.	1	24	17		2	44
Under stones		4	13			17
In dead trees	3	3				6
Flying or sweeping	111	37	39	20	3	210
Flower visitors	4	4	1		6	15
Galls and leaf miners	25					25
Fungous forms		44	9			53
Scales and aphids	8					8
Totals	155	146	83	20	11	415
Per cent. of total	37	35	20	5	3	100
THICKET						
Pool			4			4
Flying or sweeping	148	21	45	18	1	233
On flowers	4	5	1	1	5	16
Galls	14					14
Aphids	6					6
Totals	172	26	50	19	6	273
Per cent. of total	63	9	19	7	2	100

Thus in the woods about 37 per cent. of the species were phytophagous, about 35 per cent. saprophagous, and this percentage appears reasonable in view of the dead timber and moist conditions; 20 per cent. consisted of predaceous species, 5 per cent. of parasitic species, etc. The 5 per cent. for parasitic forms is probably low and could have been increased by more diligent collecting of the small parasitic species in the Hymenoptera.

In the thicket 63 per cent. of the species collected were phytophagous, 9 per cent. saprophagous, 19 per cent. predaceous, etc. The large percentage of phytophagous forms appears to be due to the larger herbaceous flora of the thicket, the presence of more sunlight and warmth and the absence of conditions which would support saprophagous insects.

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LIST OF PLANTS AND INSECTS OF SURVEYED AREA.

On account of the expense connected with the printing of long lists of scientific names, it was necessary to omit from this paper the detailed list of the plants and insects found or noted during the survey. However a typewritten copy of this list together with a copy of this paper have been deposited in the library of The American Museum of Natural History, New York, N. Y.

EXPLANATION OF PLATES XXIV, XXV, XXVI.

PLATE XXIV.

FIG. 1. A winter view of the thicket showing the dense growth of young trees.

FIG. 2. Entrance to one of the grassy, open spaces in the thicket.

FIG. 3. A clump of birches still surviving in open portions of the woods.

FIG. 4. Winter view of thicket showing surviving cedars.

FIG. 5. A winter view of the woods showing type of tree growth.

FIG. 6. A winter view of the woods showing stumps and logs succumbing to attacks by Polypores.

PLATE XXV.

FIG. 7. A dense portion of thicket showing clump of birches and group of May apples.

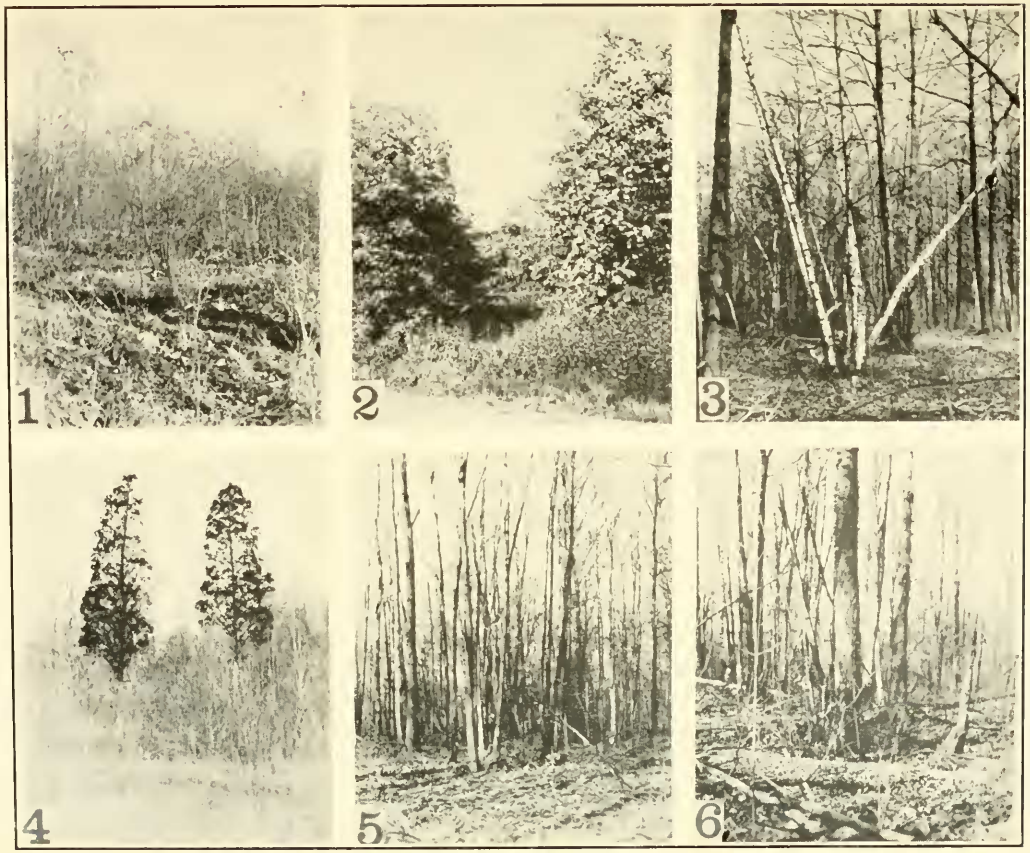
FIG. 8. Spring view of woods showing early ground flora.

FIG. 9. View of thicket showing dense growth of young trees.

FIG. 10. One of the many wet spots in the woods with decayed tree at right.

FIG. 11. A pool in the thicket.

FIG. 12. A spring view of the floor of the woods.



INSECTS OF A MOIST WOODS.